

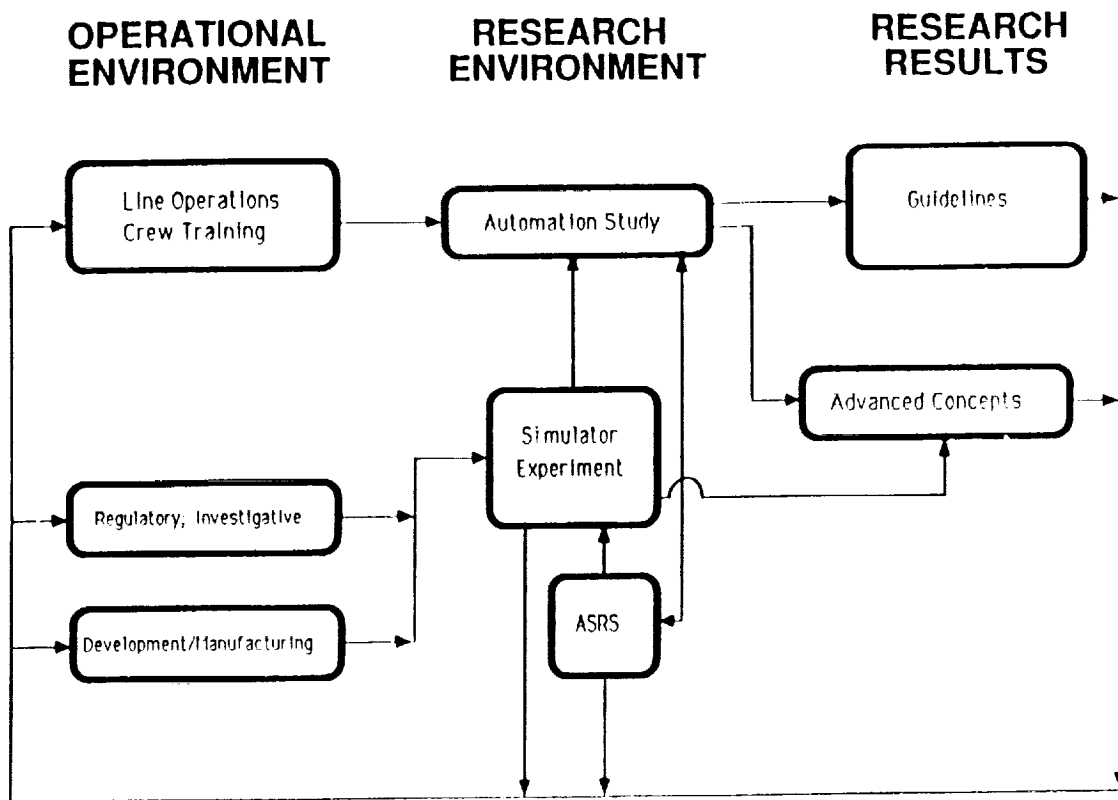
HUMAN FACTORS OF THE HIGH TECHNOLOGY COCKPIT

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ABSTRACT

The rapid advance of cockpit automation in the last decade has outstripped the ability of the human factors profession to understand the changes in human functions required. High technology cockpits require less physical (observable) workload, but are highly demanding of cognitive functions such as planning, alternative selection, and monitoring. Furthermore, automation creates opportunity for new and more serious forms of human error, and many pilots are concerned about the possibility of complacency affecting their performance.

On the positive side, the equipment works “as advertised” with high reliability, offering highly efficient, computer-based flight. These findings from the cockpit studies probably apply equally to other industries, such as nuclear power production, other modes of transportation, medicine, and manufacturing, all of which traditionally have looked to aviation for technological leadership. The challenge to the human factors profession is to aid designers, operators, and training departments in exploiting the positive side of automation, while seeking solutions to the negative side.



INCIDENTS AND ACCIDENTS

MARINE

Herald of Free Enterprise

Exxon Valdez

PRODUCTION

Three Mile Island

Chernobyl

Bhopal

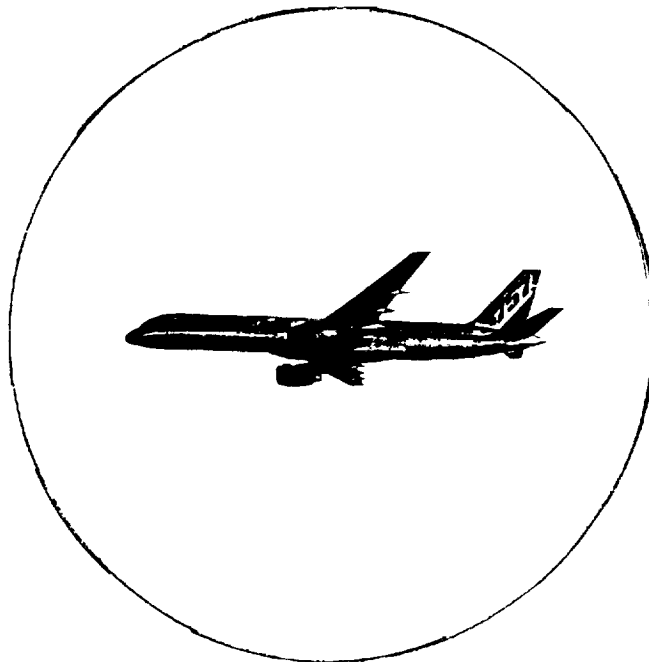
MILITARY

U.S.S. Vincennes/Iran Air 655

CRM ISSUES

- **Who does what (SOPA)**
- **Supervision**
- **Shift of authority**
- **Independence of crew members**
- **Failure to coordinate more critical**
- **Automation requires more CRM, not less**

THE ELECTRONIC COCOON



FINDINGS

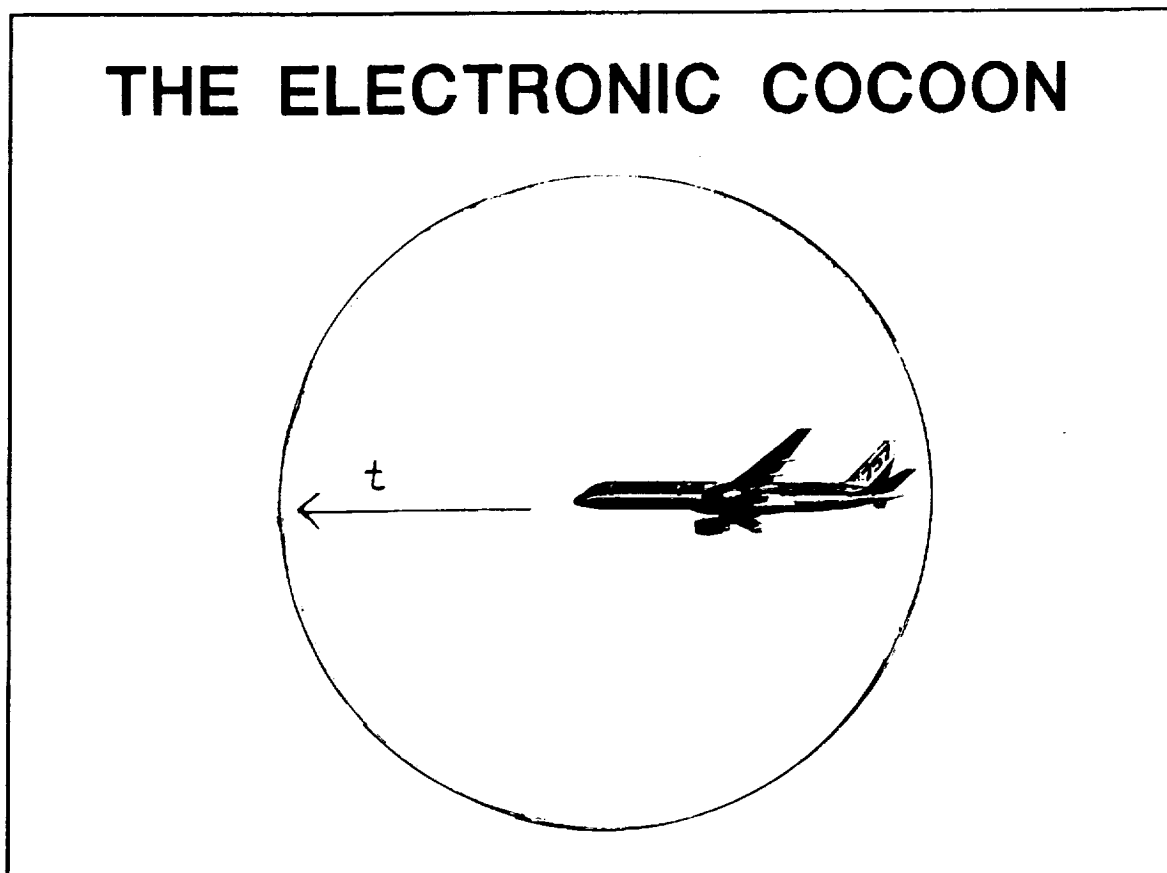
- High enthusiasm for 757, but reservations about safety
- Workload may be increased or decreased
- Less time head-up in terminal area
- Two vs. three pilots still at issue
- Training overall good, but too much emphasis on automation rather than basics
- ATC limits exploitation of 757 features especially VNAV
- Crew coordination critical in glass cockpit

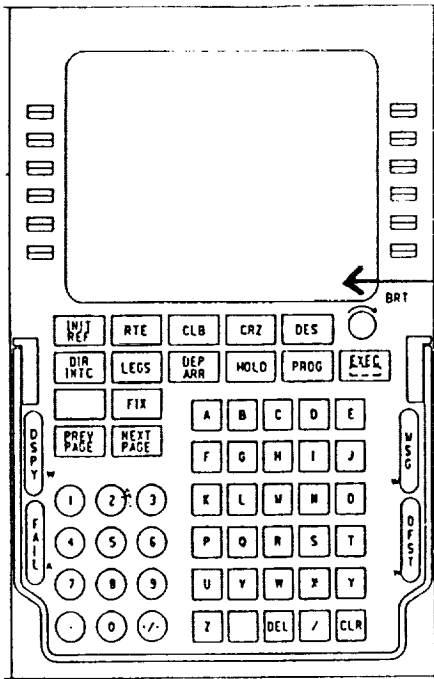
INTERVENTION STRATEGIES

- **BASIC HUMAN ENGINEERING**
- **CREW COORDINATION TRAINING**
- **INTELLIGENT WARNING AND ALERTING**
- **ERROR-EVIDENT DISPLAYS**
- **PREDICTIVE WARNING SYSTEMS**
- **INTENT-DRIVEN SYSTEMS**

CONCLUSIONS

- Equipment
- Errors
- Training
- Workload
- ATC





"INSUFFICIENT FUEL"